The Virtual Magnetospheric Observatory VMO/U

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Our Proposed Goals

- Provide a single request point (portal) for all data repositories needed for magnetospheric research.
- Provide tools for preparing data archives.
- Provide services or access to existing services to reformat, manipulate, analyze and display data.
- Identify and register magnetospheric resources.
- Expand data model to support data processing (services) and data quality.

Approach

- Community-wide standards are essential.
  - Data Model
  - Core Functions
  - Archive Content (documentation, ancillary data, etc.)
- We will use the SPASE data model and XML representation for metadata.
- Work through the SPASE consortium to expand the model to support:
  - Services
  - Resource details (structure)

Science Constituency Served

- Providers
  - Data Centers
  - Missions
  - Resident Archives
  - Individual Researchers with Data to Share
- Consumers
  - Graduate Students
  - Professional Researchers
- Types of Studies
  - Statistical
  - Case
  - Engineering

Who's Doing What

- **Raymond J Walker – P.I.**
  - VMO Project Manager
  - Services and simulations domain expert.
- **Christopher T. Russell – Co-I.**
  - Magnetospheres domain expert.
  - Direct ITM and ground activities
  - Secure access to Polar, Geotail and FAST resources.
- **Robert L. McPherron – Co-I.**
  - Space weather domain expert.
  - Direct magnetospheric / solar wind coupling activities
- **Peter Chi – Co-I.**
  - Liaison to ITM community.
  - Identify and document ground data sets (magnetic field, radar, ionosonde, event lists, magnetic activity indices)
- **James Weygand – Co-I.**
  - Liaison to solar and heliospheric community.
  - Identify and document solar and heliospheric data sets.
- **Lee Bargatze – Co-I.**
  - Identify and document magnetospheric observations (Assist Russell and McPherron)
- **Todd A. King**
  - System engineering and development expert.
  - Develop tools, web services and VMO framework.
  - Manage day-to-day operations of the VMO.
- **Steven P. Joy**
  - Data modeling and database expert.
  - Assist mission and resident archives (lead)
- **Joe Mafi**
  - Data engineering expert.
  - Provide operational support to missions and resident archives in generating metadata.
- **Science Steering Committee**
  - Community experts.
  - Guidance to the VMO.

Datasets to be Made Available

- Existing (and stable) repositories
  - Repositories held at UCLA
    - Weygand/McPherron database (ACE, Geotail, IMP8, Interball, ISEE1, ISEE2, ISEE3, Wind)
    - Ground Station Chain data (McMac and others)
    - IMP8
    - FAST
    - Geotail
    - Polar MFE
    - ISEE Magnetometer
  - Active Missions
    - Cluster
    - THEMIS (soon)
    - ST-5
  - Resident Archives
    - SAMPEX
    - Polar (soon to be)
  - other repositories identified by our team of experts.

Emerging Repositories

- Expectation that repositories funded as data services would register with VMO.
  - SwRI (Joey Mukherjee)
  - Geotail (Joseph King)
  - Energetic Particles (Jon Vandergriff)
- Expectation that the VMO "holdings" would grow voluntary additions.
  - VMO liaisons encourage community participation.

Infrastructure Tools and Services

- The VMO will redeploy existing tools and services to build the infrastructure.
- Tools to enable repositories to participate in the VMO

- Repository
  - Re-engineer the PDS metadata generation tools to generate SPASE XML descriptions.
  - SPASE XML description validation tool (new)
  - Resource inventory tool (prototype)
- Registry
  - Database Schema (prototype)
  - Metadata collection - harvesting (prototype + enhancements)
  - Web interface (new)
- Portal (search and services interface)
  - Search (single “point of question”) – (prototype)
  - Resource Retrieval and Packaging – (prototype + new)
  - Concurrency tools (system synchronization) – (new)
  - Announcement (RSS, subscription) – (prototype)
  - Accounting (metrics on usage) – (new)

Value Added Services

- Leverage existing services

- Format translation
  - Tables: flatfile, CDF, HDF, FITS table to ASCII
  - Images: to and from FITS, JPEG, GIF, PNG and TIFF
- Resetting
  - Subsetting: Extract a part of resource.
- Coordinate Transformation
  - Tsygenenko rotations.

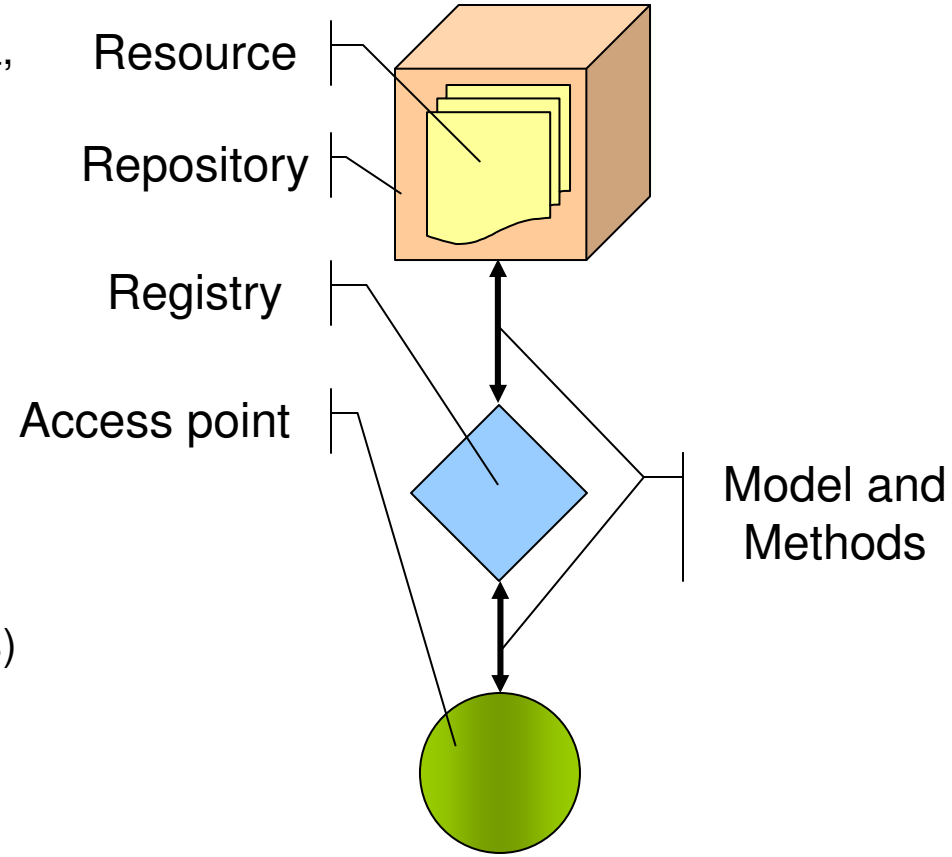
Overall Architecture

(building block)

- **Resource**: An object (document, data, etc.) or service available for use.
- **Repository**: A facility for storing and maintaining digital information in accessible form
- **Registry**: A collection point for metadata about resources.
- **Access Point**: An interface to the registries and resources.

The glue that binds:

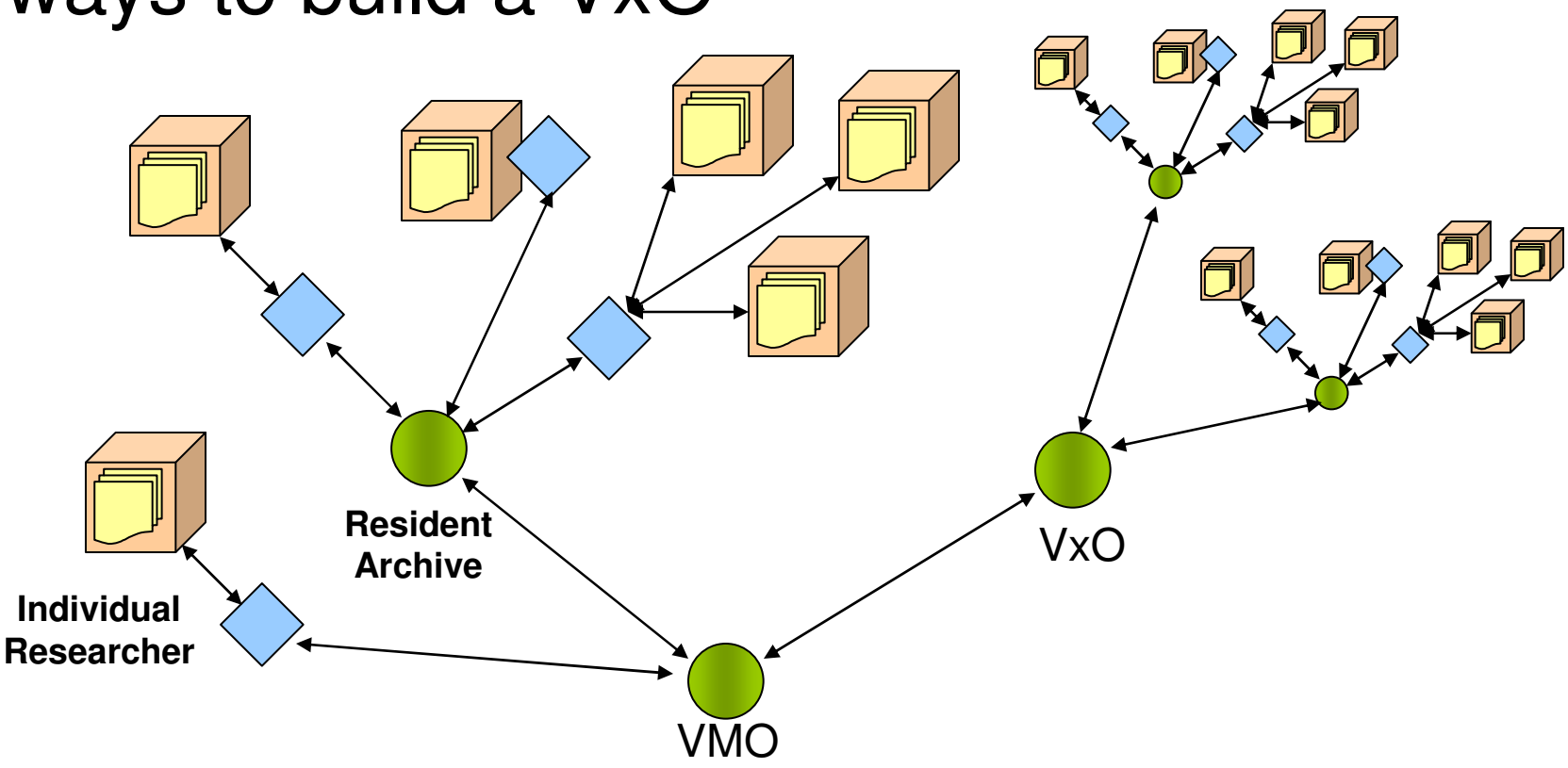
- **Data Model**: Describes in an abstract way how data is represented. This includes semantics (meaning of terms) and ontology (relationships).
- **Access Methods**: Mechanisms to search for, use and distribute resources.



Overall Architecture

(big picture)

- Components can be combined in multiple ways to build a VxO



Overall Architecture

- REST (Representational State Transfer)
  - Fancy acronym for the current web.
    - URLs to reference a resource and streams (bytes or XML documents) as response.
    - Services and "document" resources are analogous.
- Resource descriptions are represented in SPASE XML.
- Basic Registry
  - Resource description (individual SPASE XML descriptions)
  - Resource manifest (list of resource descriptions)
- Advanced Registry
  - Searchable resource descriptions
  - Retrieval services
  - Implementation: Use OAI? Develop VxO methods? Let SPASE define?

Milestones/Timeline

Year 1

Register resources and ...

- Q1
  - Steering Committee review
  - Operational portal
  - Registry services
  - Description generation/validation tools
  - Package and retrieve
- Q2
  - Format translation (tables)
  - Community training
  - Register services (struct. ind.)
  - Pick the low laying resources.
- Q3
  - Format translation (images)
  - Add resources to system
- Q4
  - Subsetting
  - Add resources to system

Year 2

Register resources and operational improvement and …

- Q1
  - Steering Committee review
  - Coordinate system transformation.
  - Add resources to system
- Q2
  - Community Training
  - Register services
  - Add resources to system
- Q3
  - Register services (struc. dep.)
  - Add resources to system

Year 3

Register resources and operational improvement

- Q1
  - Steering Committee review
  - Add resources to system
- Q2
  - Community training
  - Add resources to system

Methodology for user Feedback

- Comments and suggestions through VMO.
- Science Steering committee.
- VxO workshops
- Person-to-Person contacts (our experts)
- Presentations at conferences.